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Direct Quadrature Method of Moments for LES-based Modeling of Supersonic Combustion PRATIK DONDE, HEESEOK KOO, VENKAT RAMAN, University of Texas at Austin — The LES/transported probability density function (PDF) model has been successfully used for predictive modeling of turbulent combustion in low-speed flows. The PDF approach evolves the joint-distribution of the gas-phase thermochemical composition and is ideally suited for supersonic flows, where conserved-scalar approaches are not valid due to the compressible nature of the flow. In low-speed flows, the high-dimensionality of the PDF transport equation is handled through the use of Monte-Carlo based stochastic methods. However, the presence of shocks and large density and pressure gradients pose significant challenges in the use of these stochastic methods for high-speed flows. In this work, we propose a direct quadrature method of moments (DQMOM) approach, which is a fully Eulerian method for solving the PDF transport equation. Here, the subfilter PDF is discretized in terms of a finite number of delta functions, each characterized by a weight and an abscissa. Eulerian transport equations for these quantities are similar in structure to scalar transport equations and can be solved using finite-volume/finite difference approaches. Here, the accuracy of the DQMOM approach and the numerical implementation of this method using shock-capturing schemes are discussed.

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